Behavior of Cerium Ions in Glasses Exposed to X-rays

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cause crystallization of lithium metasilicate partially (40%) from the base glass, and finally at 900°C for 60 min. to convert almost the whole of the base glass to polycrystalline materials consisted of lithium disilicate and β-quartz. The grain size of the constituent crystallites of the resultant material was able to be varied from 0.85 to 2.3μ by changing the U. V. exposure time (Ref. M. Tashiro and S. Sakka, *J. Ceram. Assoc. Japan*, **67**, 263 (1959)).

Tests for bending strength and Vickers hardness were made with two classes of specimens, one which completed a whole course of the abonve heat treatments and the other which completed only the first half of the heat treatments, i. e., heated only up to 620°C.

The tests have shown that, for the specimens which completed the whole course of the heat treatments, crystallization increases mechanical strength of the specimens, and the relation between the average grain size of the constitiuent crystallites (d) and the mechanical properties (M) (both of the bending strength and Vickers hardness) is given by the equation,

$$M = \text{const} \cdot d^{1/2}.$$

For the specimens heated up to 620°C, partial crystallization of the glass phase was found to increase the mechanical strength of the specimens but in somewhat more complex way. This was attributed to the effects of glass phase still remaining in considerable amounts (60%) in the specimens.

Behavior of Cerium Ions in Glasses Exposed to X-rays

Megumi TASHIRO, Naohiro SOGA and Sumio SAKKA

Yogyo Kyokaishi (Journal of the Ceramic Association, Japan), **68**, 169 (1960)

Silicate glasses exposed to high-energy radiation develop three visible absorption bands similar to the F- and V-band in alkali halide crystals (R. Yokota, *Phys. Rev.*, **91**, 1013 (1953), **95**, 1145 (1954), **101**, 523 (1956); A. Kats and J. M. Stevels, *Philip Res. Report*, **11**, 103, 115 (1956)). The function of cerium in suppressing formation of these bands were studied spectrophotometrically in glasses of composition 20 R_2O, 10 BaO, 70 SiO_2, and 0.03 to 0.3 mol% CeO_2 (R_2O: Li_2O, Na_2O, K_2O).

Glass specimens of about 0.1 mm in thickness were irradiated with X-rays of 42 kV, 10mA, and changes of their absorption spectra in the range 230 to 800 mμ were measured with the Beckman photoelectric spectrophotometer. As the absorption changes were found to be caused not only by color centers but also by other sources such as the valency change of cerium ion, the change due to color centers were separated from the others by heating the irradiated specimen at 150°C for 30 min.; the decrease in absorption intensity by the heating was taken as the absolute change of the absorption due to formation of color centers.

The experimental results showed that trivalent cerium ions suppress development of the three absorption bands equally; i. e., trivalent cerium ions are effec-

tive in preventing formation of either of those structural imperfections associated with trapped electrons or positive holes holes. As to the valency changes of cerium ion itself, a small part of trivalent cerium ions was found to loose their electron upon irradiation by the reaction

$$Ce^{3+} + h\nu \rightarrow [Ce^{3+} \text{ with positive hole}] + e^{-}.$$

Use of Ordinary Plate Glass as a Gamma-Ray Dosimeter

Megumi TASHIRO, Sumio SAKKA and Naohiro SOGA

Yogyo Kyokaishi (Journal of the Ceramic Association, Japan), **68**, 191 (1960)

The gamma-ray dose rate distribution in a small closed space, 80mm in dia., 110mm in height, was determined by the use of small pieces of ordinary plate glass, 15×6×1.72mm, as a dosimeter. The technique of the measurement was described. The advantageous features of the glass dosimeter, i.e., its small size, convenient usage, and preciseness in the measurement, were discussed. A brief description of the construction of a small Co-60 irradiator, in which the measurement was made, was appended.

Mechanicel Strength of Polycrystalline Materials Propuced from Platinum Containing Glasses

Megumi TASHIRO, Sumio SAKKA and Masamichi WADA

Yogyo Kyokaishi (Journal of the Ceramic Association, Japan), **68**, 223 (1960)

Rindone found that a small amount of platinum (0.01%) introduced into a glass of the composition $Li_2O \cdot 4SiO_2$ acts as a nucleating agent on reheating, converting the whole mass into an assembly consisting of extremely small crystals (G. E. Rindone, *J. Am. Ceram. Soc.*, **41**, 41 (1958)).

This paper presents the results of the investigation of authors which covers the nucleation by platinum for glasses contaning Li_2O, MgO, Al_2O_3, and SiO_2. The bending strength was used for the evaluation of the effect of the nucleating agent.

(1) **Optimum amount of platinum.** The glasses of the composition, Li_2O 12.5, K_2O 2.5, Al_2O_3 4, SiO_2 81% by weight, added, respectively, with 0, 0.001, 0.01, 0.1% of platinum were formed into the specimens of the size 50×5×2.5mm. Taking the density increase as a reference the effect of the concentration of platinum on the devitrification of the specimens under a stepwise heat treatment was investigated. It was found out that 0.01% was sufficient for the completion of devitrification.

The bending strength of the devitrified specimen increased with increasing platinum content. Taking into consideration of the cost of platinum the authors